

Tuberculosis

Prevention and Treatment



Navy Environmental & Preventive Medicine

Revised 7/2000

Unit 2

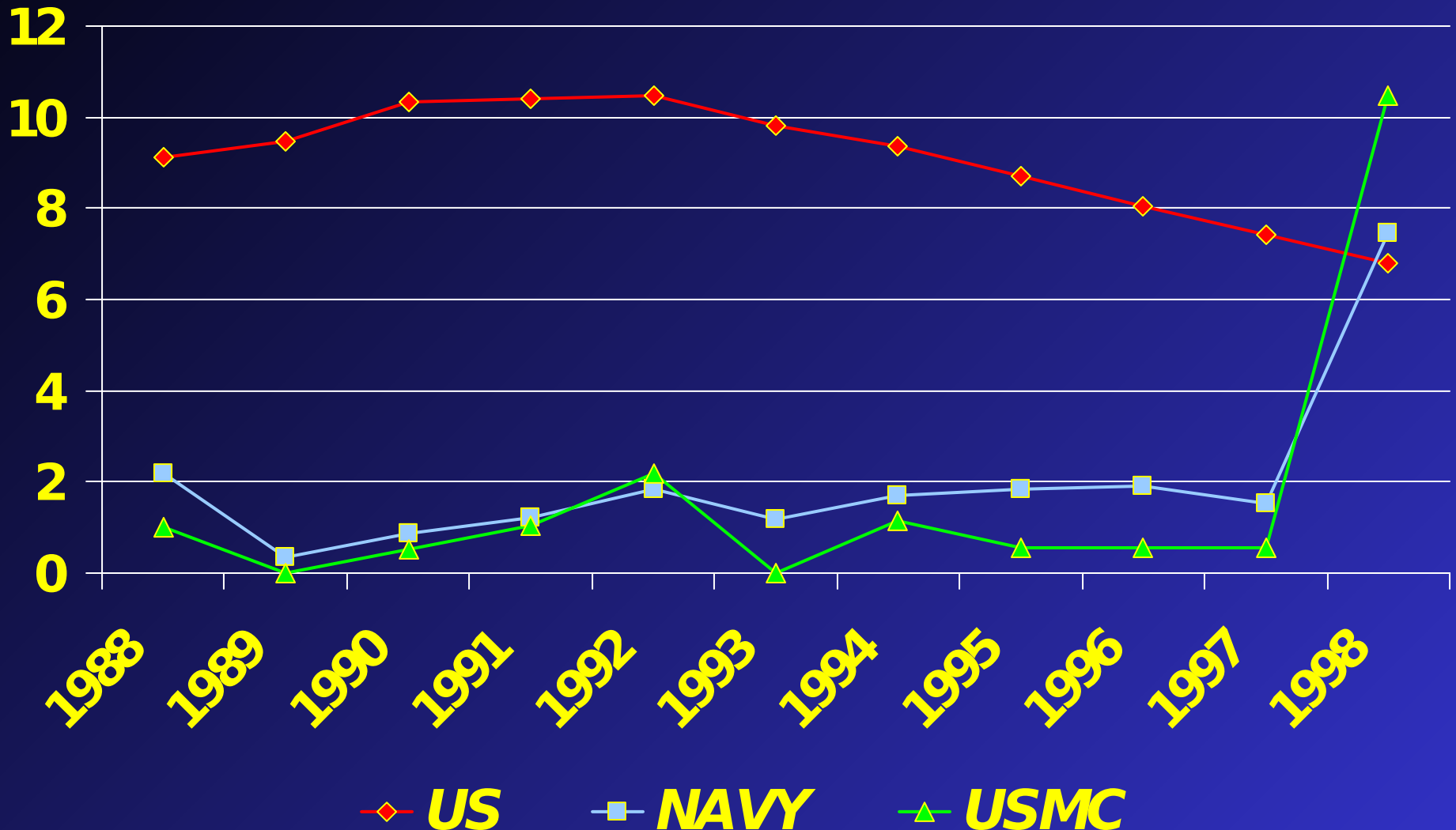


Class Objectives

- Explain why the Tuberculin Skin Test (TST) Tuberculosis is problematic in the detection and control of TB
- Identify what constitutes a positive TST
- Identify the 4 required components of a routine “work-up” of a new reactor
- Explain the difference between an Active TB case and a Reactor
- Identify individuals who should be screened in a contact investigation

Epidemiology of TB, 1988-1998

United States, Navy, Marine Corps, Rates/100,000_





Overview

BUMEDINST 6224.8, 08 FEB 1993

- Administration of TST (PPD)**
- Interpretation of Tuberculin skin test (TST)**
- Documentation**
- Converter vs. Reactor**
- Diagnosis**
 - ✓ Active
 - ✓ Infected
- Prophylaxis & Treatment**
- Contact Investigation & Case Presentation**



TST Administration

→ Definitions/Acronyms

- TST: Tuberculin Skin Test
- PPD: Purified Protein Derivative

“tuberculosis poo”

→ Problematic step in TB Prevention and Control

- ✓ Properly apply
- ✓ Get personnel to return for “reading”
- ✓ Correctly interpret

Administration of PPD

Mantoux method

- 0.1 ml intermediate strength PPD in TB syringe
 - Intradermal injection on volar aspect of forearm
 - Raise a small, pale, sharply demarcated wheal
 - If no wheal appears, apply another test in opposite arm
- See handout - BUMEDINST 6224.8, Encl (1), Page 4





TST

Interpretation

Examine site in 48-72 hours

→ **Measure induration in millimeters at its widest transverse diameter**

→ **Record induration**

→ **Interpretation**

✓ **5 mm positive in contact investigation**

✓ **10 mm positive in**



- Image of TST 48 hours after injection

➤ “Ballpoint pen” method – pen run along skin until it hits edge of swelling

➤ Measurement: 30 mm x 45 mm

TST Interpretation



← **Positive TST. Note that the pen line marks the extent of erythema (redness), not induration (swelling).**

→ **Image of strongly positive TST**



TST Interpretation



1. Blistering over TST injection site. Such vigorous blistering suggests active TB.

2. Blistering over site of TST injection site in a young girl who presented with cervical lymphadenopathy.

3. TST 48 hours after administration. This is a



TST Interpretation

5 mm also positive in:

- ✓ **Persons known or suspected to have HIV infection**
- ✓ **Persons who have a chest radiograph suggestive of previous TB**
- ✓ **Persons who inject drugs (if HIV status unknown)**
- ✓ **Close contacts of a person with infectious TB**



TST Interpretation

≥ 10 mm is positive in:

- ✓ Persons with certain medical conditions, excluding HIV
- ✓ Foreign-born persons from areas where TB is common
- ✓ Low-income populations, including high-risk racial & ethnic groups
- ✓ Residents of long-term care facilities
- ✓ Children younger than 4 years of age
- ✓ Persons who inject drugs (if HIV status negative)

≥ 15 mm is positive in: all persons with no known risk factors for TB



Documentati on

- **Record results in medical record/SAMS**
 - ✓ **Date**
 - ✓ **Strength (e.g., PPD 5 TU)**
 - ✓ **Diameter of induration**
- **Record size of any induration (even if 3mm)**
- **Enter complete absence of induration as “zero mm” (*not negative or positive*)**



Documentation: *What if?*

- If person returns more than 10 days after TST, enter “not read” and apply new TST in opposite arm
- If more than 7 days and less than 10 days has elapsed since application of TST:
 - ✓ If induration is 15 mm or more, record results and treat per instruction
 - ✓ If uncertain if reaction is 15 mm or more, repeat test in opposite arm



Converter vs. Reactor

Reactor: Positive TST without signs or symptoms of active disease. Considered to have TB infection, prophylaxis indicated

Converter: A Reactor who has a documented negative TST in the preceding 2 years, prophylaxis indicated

Prior Reactor: had a positive TST and may or may not have been treated

Non-reactor: TST area of induration less than 5 mm



TB Evaluation Decisions

➔ Is active disease present?

- ✓ TST result (amount of induration)
- ✓ Why tested? Routine screening or Contact
- ✓ Reactor vs. Converter
- ✓ History, signs & symptoms
- ✓ Work-up: CXR, sputum smear/culture

□ Active disease not present:

- ✓ Preventive therapy with INH indicated for all age groups for 6 or 9 months (9 months: HIV, fibrotic CXR)
- ✓ Contraindications to INH, then:
 - Rifampin and Pyrazinamide for 2 months
 - Rifampin for 4 months
- ✓ Is B-6 therapy indicated?



Routine required

Work-up

- ➔ **History & physical**
- **CXR for newly identified Reactor of >10 mm induration (5 mm if in a high risk group, close contact)**
- **Baseline liver function tests**
- **HIV test**



S/S of Active Disease

Signs & Symptoms

- ✓ Prolonged, productive cough (>3 weeks duration)
- ✓ Chest pain
- ✓ Blood in sputum
- ✓ Fever, chills
- ✓ Night sweats
- ✓ Fatigue easily
- ✓ Loss of appetite
- ✓ Weight loss



Diagnosis of Active TB

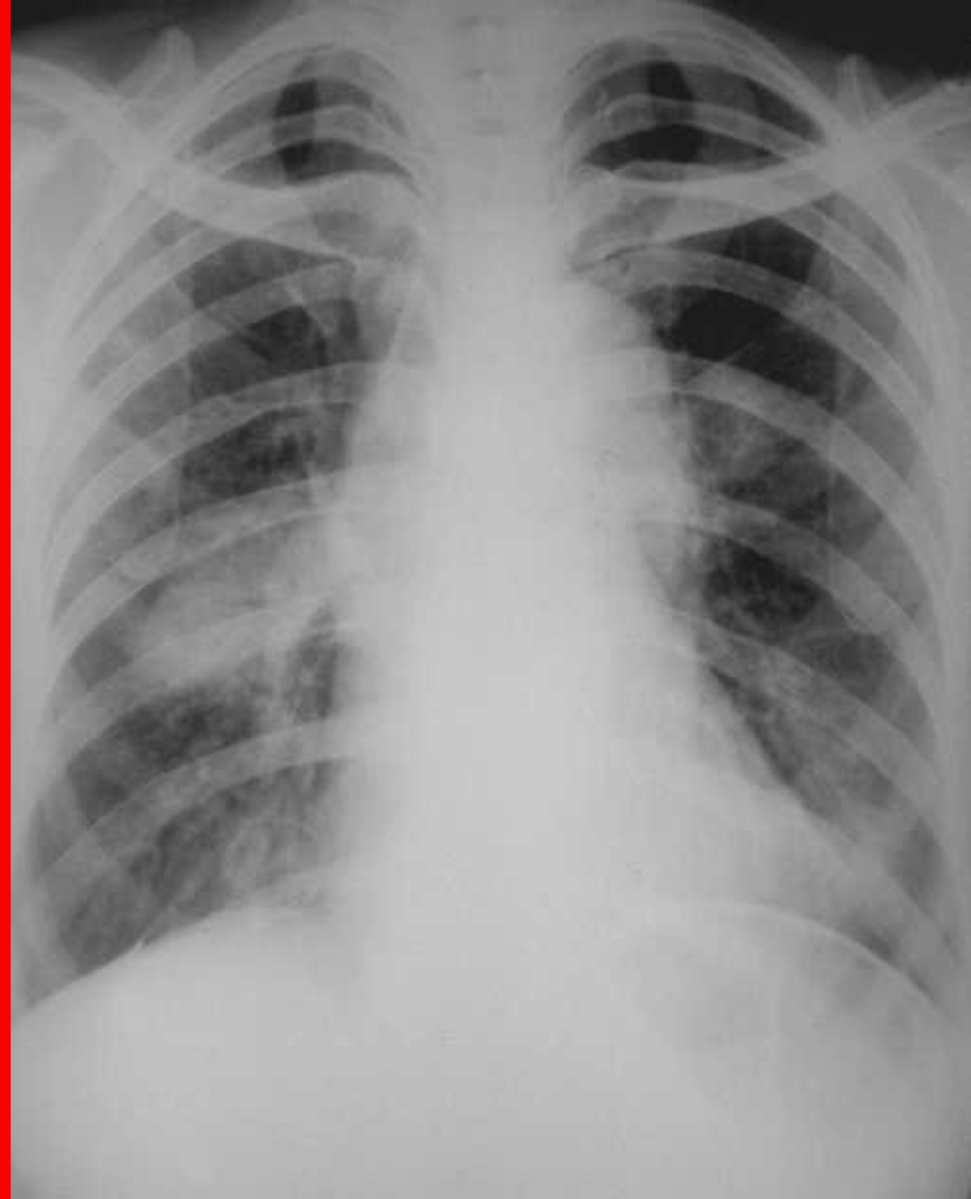
- TST
- CXR
- Sputum smear [presence of Acid Fast Bacilli (AFB) “red snappers”]
- TB culture - results take 6 weeks or more
- PCR/DNA quicker (1 week), expensive (\$234), but not definitive



Diagnosis of Active

Chest X-Ray

- X-ray of a young man showing a primary lesion (Ghon focus) in right mid-zone without evidence of hilar lymph node enlargement.
- Primary disease usually involves:
 1. Ghon focus
 2. Enlargement of hilar lymph nodes.
- This combination of features is called a primary or Ghon complex.





Diagnosis of Active

TB

Chest X-Ray

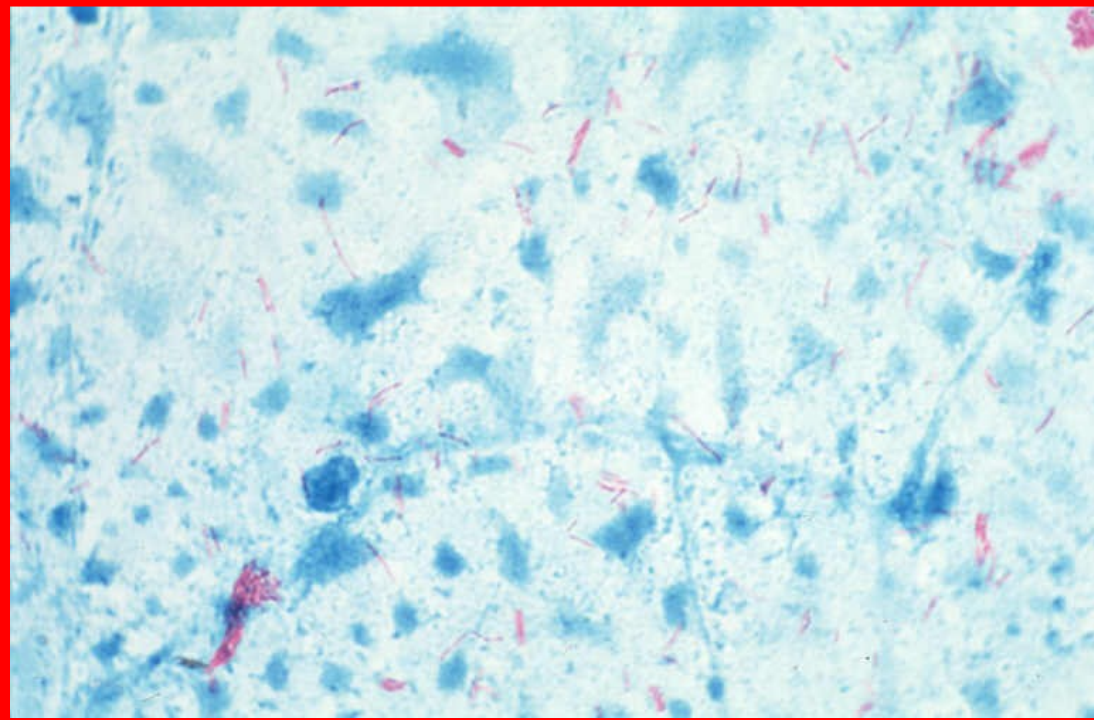
- X-ray of a young man with a large cavitating nodule in the left mid-zone, close to the hilum. A sputum culture grew *Mycobacterium tuberculosis*.
- This is primary tuberculosis with breakdown of a Ghon focus, but no visible left hilar lymphadenopathy.





Diagnosis of Active

TR



- ↑ Sputum smear showing acid-fast bacilli (AFB) of *Mycobacterium tuberculosis*
- Mycobacterial culture grown on egg based media called Lowenstein-Jensen (LJ) medium, generally grown on a solid slope as shown here



Diagnosis of Active TB



↑ **Cross section of lung showing large well defined tuberculous lesion**

→ **Post-primary tuberculosis with cavity in left upper zone, shadowing above the left hilum, smaller nodular shadows scattered throughout the mid and upper zones**

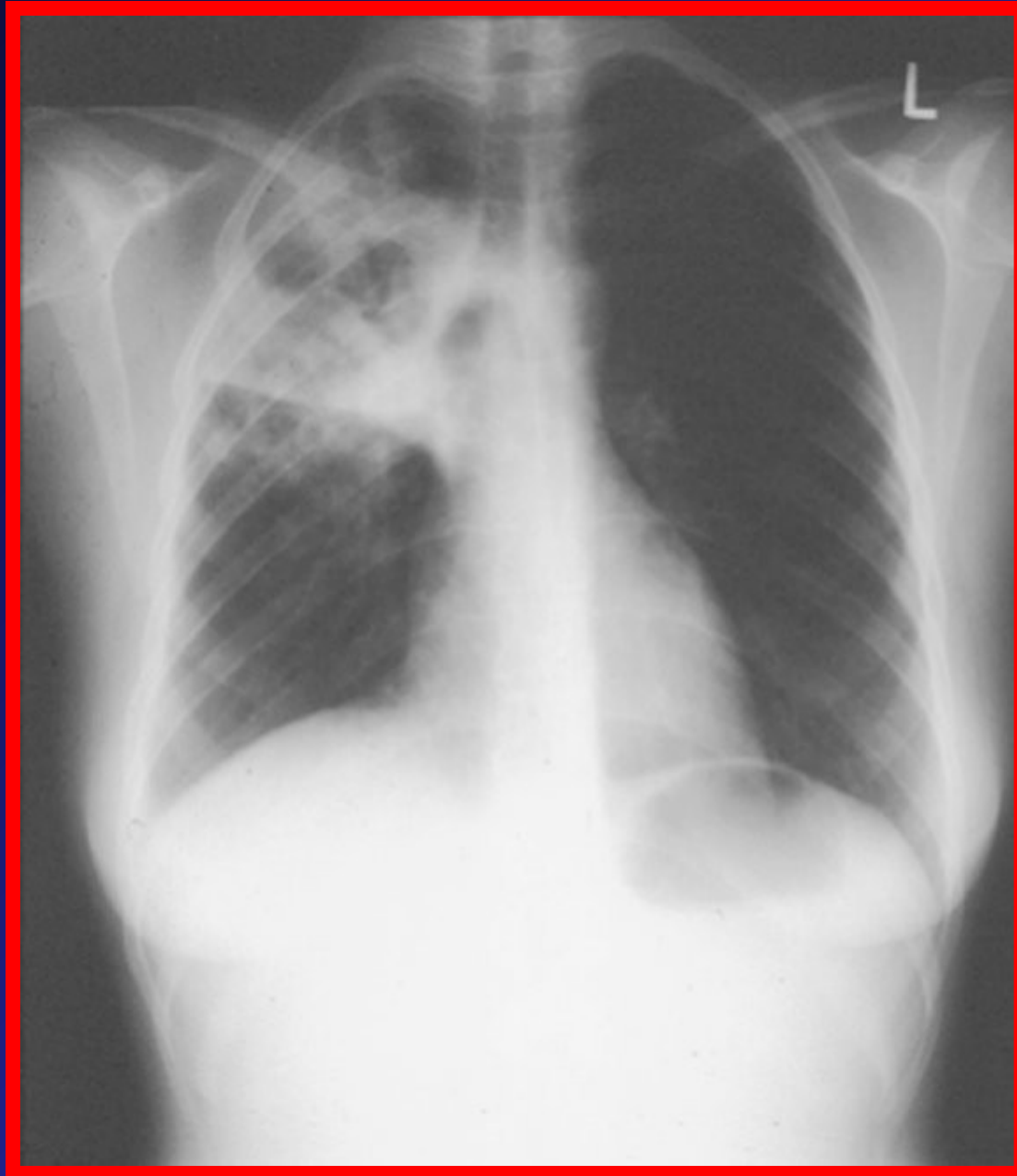


the mid and upper zones are likely to be AFB positive, such patients are highly infectious

Diagnosis of Active TB



- ↑ Right lung from elderly homeless man showing cavitation and consolidation
- Cavitation, consolidation of RUL in a 25 y/o Somali woman. Sputum smear was positive for AFB.





RX for Active

Cases

→ 6 months of continuous therapy consisting of:

- ✓ 2 months of 4-drug therapy Rx**
 - Isoniazid (INH)**
 - Rifampin (RIF)**
 - Ethambutol (EMB)**
 - Pyrazinamide (PZA)**
- ✓ 4 months of two drug therapy based on drug sensitivities - usually INH & RIF**



RX for Reactors

- **INH 300 mg PO QD**
- **6 months of treatment**
- **Reactors with HIV or abnormal CXR consistent with prior TB:**
 - ✓ **9 months of INH Rx**
- **Consider course of Vitamin B6 for:**
 - ✓ **Individuals who are malnourished or have neuropathies (alcoholics, pregnant women, and some children)**
- **Alternate Treatments:**
 - ✓ **Rifampin and Pyrazinamide for 2 months**
 - ✓ **Rifampin for 4 months**



Infection Control

- **High Index of Suspicion - Patients with signs or symptoms of TB**
- **Initiate effective isolation; instruct patients to cover nose and mouth when coughing, wear masks**
- **Evaluate patient for TB**
- **Start appropriate Rx if TB suspected**
- ***Field Measures: fresh air, sunlight, masks***



Infection Control

Consider patients infectious if they:

- ✓ are coughing,
- ✓ are undergoing cough-inducing or aerosol-generating procedures
- ✓ have sputum smears positive for acid-fast bacilli

and they

- ✓ are not receiving therapy
- ✓ have just started therapy, or
- ✓ have a poor clinical or bacteriologic response to therapy



Infection Control - Active TB

→ **Active TB cases considered
not contagious when:**

- ✓ **adequate therapy received for
7 days**
- ✓ **favorable clinical response to
therapy**
- ✓ **3 consecutive negative sputum
smear results from sputum
collected on different days**



Contact Investigation

- ➔ **Locate and screen close contacts of active case(s)**
 - ✓ **Close contacts include:**
 - **Spouse/significant others**
 - **Individuals sharing households, berthing compartments, and workspaces**
 - ✓ **Screen close contacts with TST immediately and in three months**
 - ✓ **Evaluate converters for active TB**

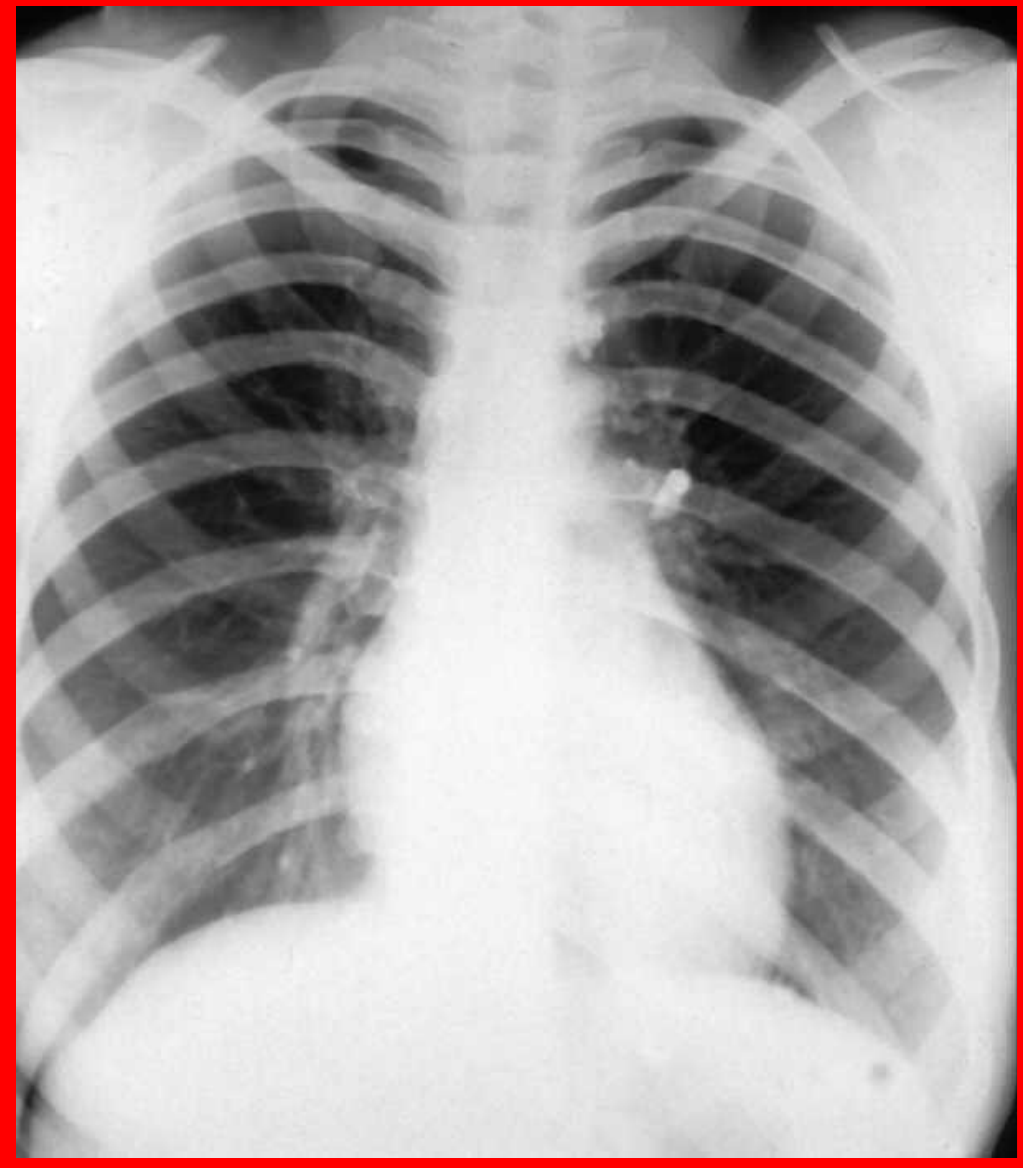


Contact

Investigation

- **Previously known reactors**
 - ✓ **Initial evaluation:**
 - **CXR**
 - **Clinical Exam**
 - ✓ **Clinical Exam to be repeated at 3 & 6 months**

- **X-ray of a young adult shows a calcified lymph node due to old healed primary TB**





1998 ARG Tuberculosis Outbreak

- **July 1998: 26th MEU and the Amphibious Ready Group, WASP (LSD-1), TRENTON (LPD-14) and PORTLAND (LSD-37) complete 5-month Med deployment**
- **Marine inpatient on WASP hospital ward transported directly to Naval Hospital Camp Lejeune and diagnosed with active pulmonary TB**
- **Contact Investigation IAW BUMED Instruction 6224.8 (8 FEB 93) began**
 - ✓ ***Converter* defined as any individual whose tuberculin skin test reacted with induration of 5mm**
 - ✓ ***Converters* received chest x-rays and were evaluated by a Medical Officer**
 - ✓ **If no evidence of active TB was found, *converters* started on a six-month regimen of isoniazid (INH)**
 - ✓ **Skin testing was repeated in three months on those whose initial tests were negative.**



1998 ARG Tuberculosis Outbreak

- **TB Case** defined as individuals who had a positive *Mycobacterium tuberculosis* (MTB) culture or chest x-ray and clinical findings consistent with pleural TB
 - ✓ All cases started on 4-drug therapy for at least two months
 - ✓ MTB drug sensitivities were determined, and therapy was narrowed accordingly to appropriate single or multiple drugs to complete 6 months of treatment
- **Prior Reactor** defined as individuals who previously reacted to a tuberculin skin test (TST)
 - ✓ *Prior Reactors* received Chest x-ray and clinical evaluation initially
 - ✓ Clinical evaluation in three months

Reminder: Place TB Cases in respiratory isolation if AFB are found in their sputum!!!

Outbreak Timeline

Feb. 26 1998, 26th MEU Embarks

**May 1998, Sailor
medevaced off USS WASP,**

TB Suspected

**June 19, WASP notified
of sailor's positive TB**

**June 19, WASP begins
initial contact
investigation**



**July 25, 26th MEU
Disembarks, Marine**

**medevaced to CLNH
July 28, Marine diagnosed with
TB**

**July 31, 26th MEU begins contact
investigation**

Initial Contact Investigation Results

→ **270 close contacts**

- ✓ 208 Navy
- ✓ 62 Marines

→ **243 Negative**

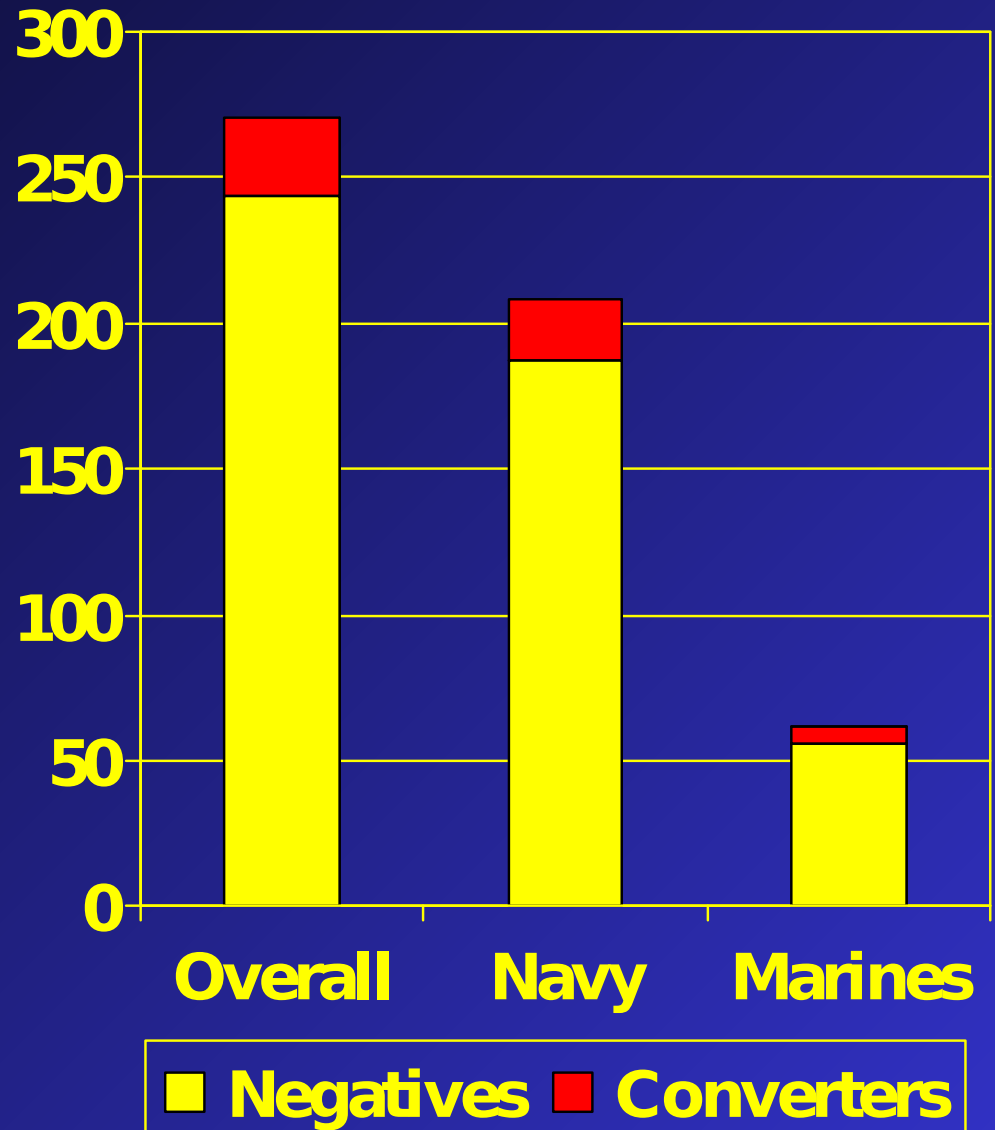
- ✓ 187 Navy
- ✓ 56 Marines

→ **27 Positive**

- ✓ 21 Navy
- ✓ 6 Marines

→ **Conversion rate:
10%**

- ✓ Navy rate: 10%
- ✓ Marine rate: 9.6%



USS WASP Contact Investigation

Results

WASP Crew:

- 1019 Total
- 132 Converters
- 3 Cases
- 85 Prior Reactors

MEU Personnel on WASP:

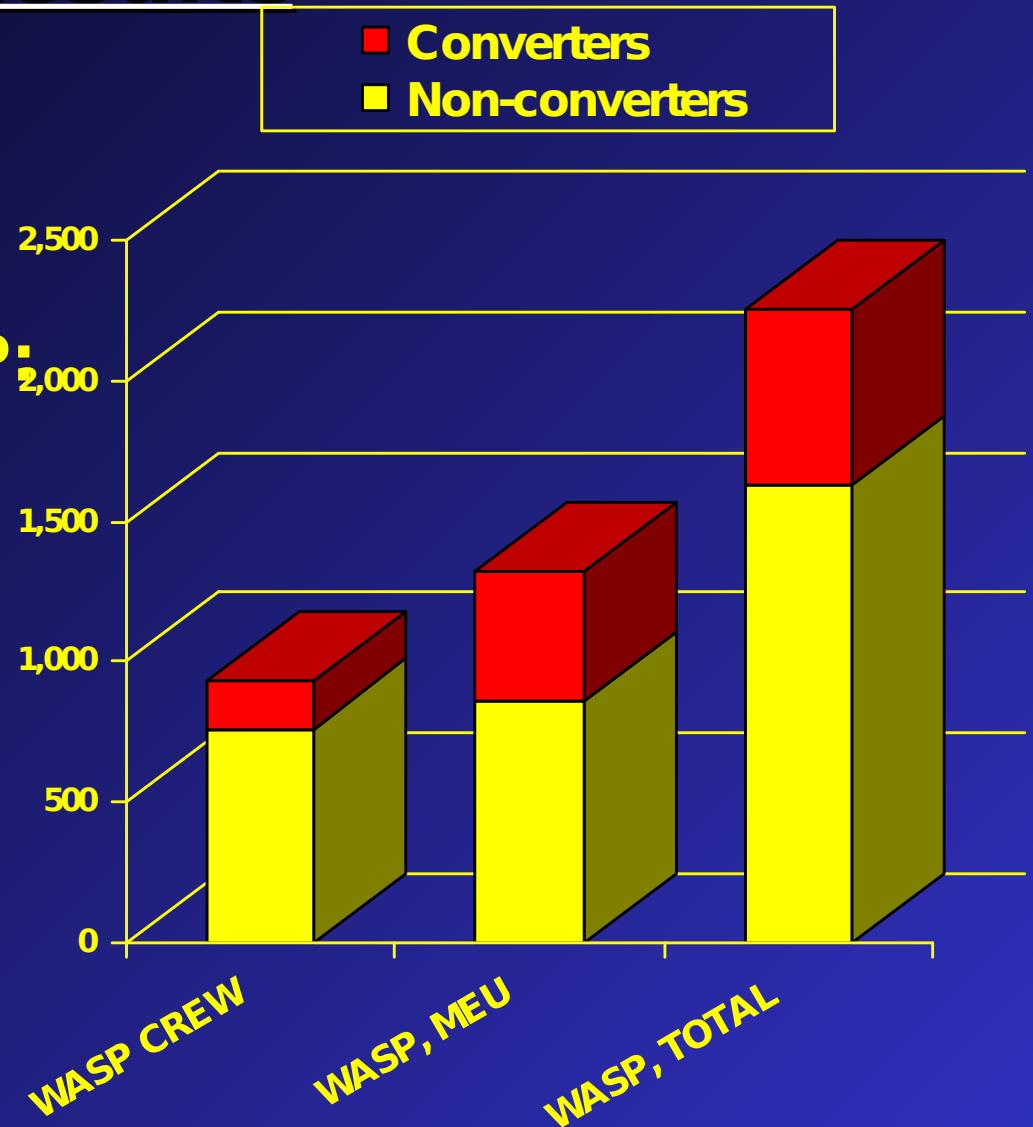
- 1304 Total
- 447 Converters
- 14 Cases
- 43 Prior Reactors

Total:

- 2323 Marines & Sailors
- 579 Converters
- 17 Cases
- 128 Prior Reactors

Conversion Rates:

- Overall: 27.8%
- WASP Crew: 18.3%
- MEU personnel: 34.6%





26th MEU Ship by Ship Conversion Rates



➤ All 26th MEU personnel

- 2157 total
- ✓ 2043 Screened
- ✓ 525 Converters
- ✓ 14 Cases
- ✓ 53 Prior Reactors
- ✓ Conversion rate: 25.2%

➤ WASP

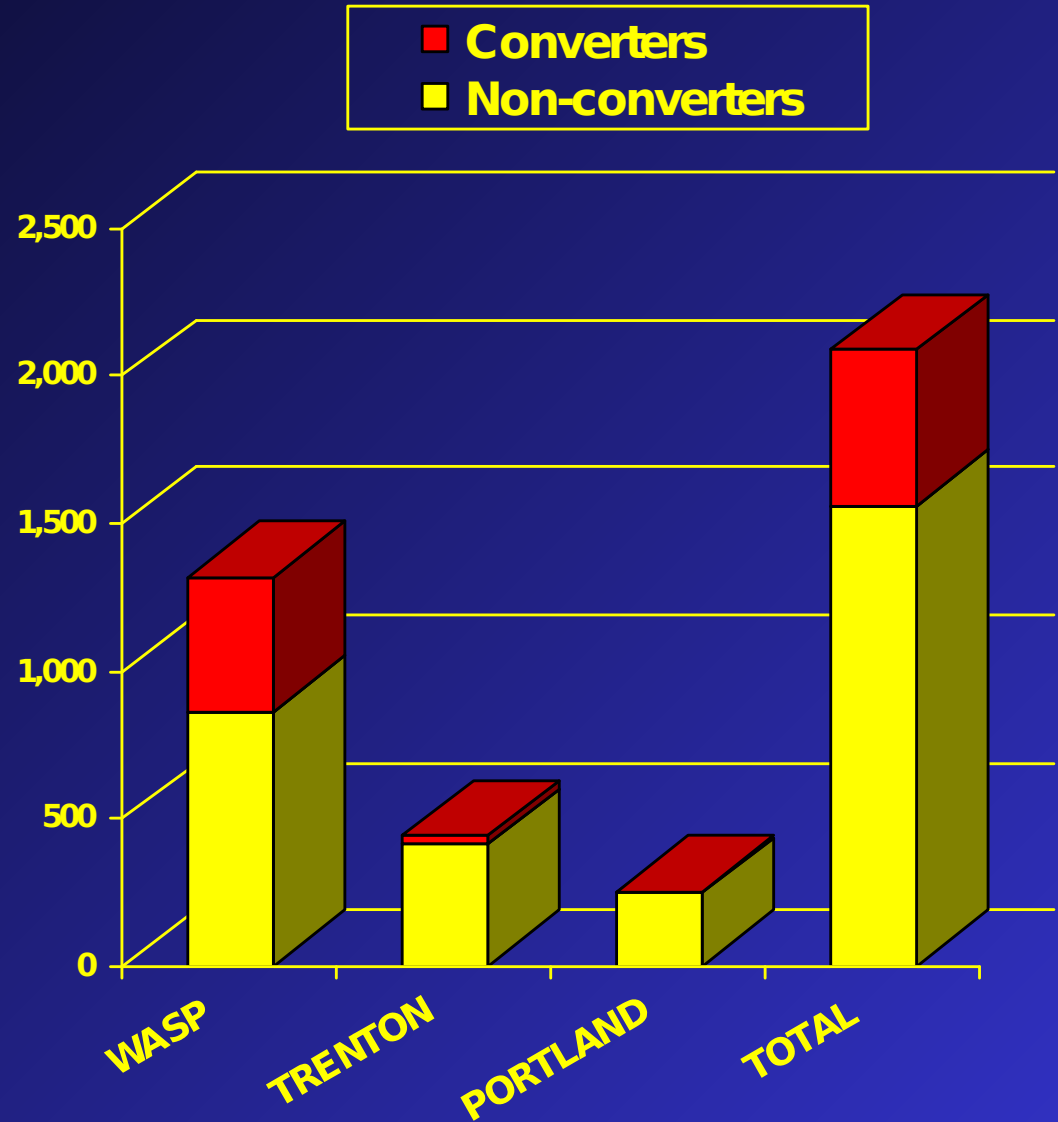
- ✓ 34% (447 of 1304)

➤ TRENTON

- ✓ 6.4% (28 of 436)

➤ PORTLAND

- ✓ 2% (5 of 245)





26th MEU

Converters

525 Converters

- 469 on initial testing
- 56 on f/u 3-month testing

56 abnormal Chest X-rays

- All had sputum specimens, bronchial washings, or pleural fluid cultured
- Positive AFB smears: 2



26th MEU Converters

14 Active Cases

- Positive sputum cultures: 7
- Positive bronchial washing cultures: 2
- Positive pleural effusion culture: 3
- Pleural tuberculosis, culture negative: 2



- WASP (LHD-1)
- Bighorn (T-AO 198)
- Portland (LSD-



USS WASP

Converted

Summer/Fall 1998

→ 171 Converters

- 132 on initial testing
- 39 on f/u 3-month testing



→ 3 Active Cases → Summer 1999

- Positive AFB smears: 0 of 3
- Positive sputum cultures: 3
- 3 more active cases
- 1 positive AFB smear

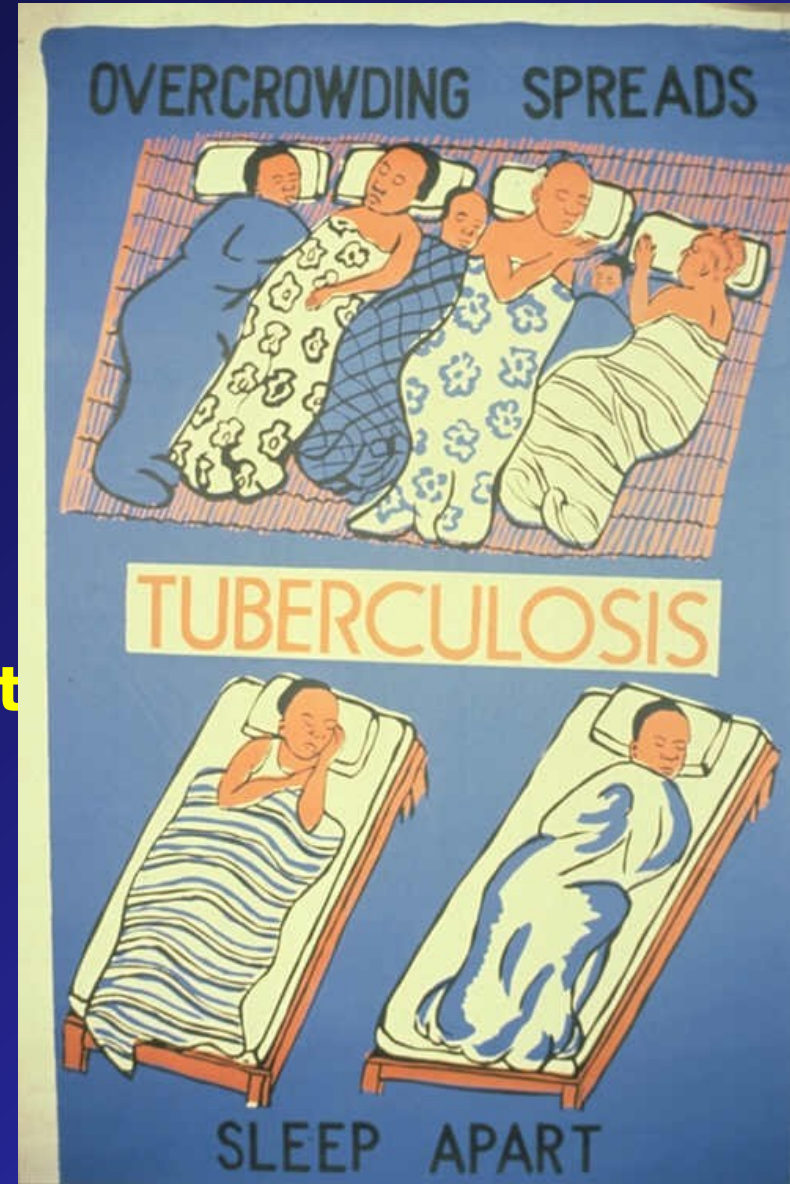


Why did the outbreak happen?

- **100% PPD Screening necessary before embark**
- **Infectious cases (USN PO1, USMC LCPL) did not get screened prior to deployment**
 - ✓ **USMC SLAP Inspection requires a minimum of 80% readiness to deploy**
 - ✓ **80% minimum readiness requirement is a compilation of completed Immunizations, DNA, HIV, and PPD screening**
- **Problems administering and interpreting tuberculin skin tests**

Lessons Learned

- **Living and working conditions aboard ship increase the risk of exposure to communicable diseases**
- **Immunizations, TB skin testing and all mandated public health practices must be followed to protect the health of embarked Sailors and Marines to ensure Combat Readiness and Mission Accomplishment**





Lessons Learned

- **Opinions differ: Does a single active TB case on a ship necessitate immediate screening of all the crew?**
YES!
 - ✓ **BUMEDINST 6224.8 permits limited close-contact investigation, but if elevated conversion rates are found the investigation must be expanded**
 - ✓ **BUMEDINST 6224.8 also states that on smaller ships it may be easier to screen the entire crew than attempting to decide who are close contacts**



Lessons Learned

- **As soon as elevated conversion rates were discovered, the initial contact investigation should have been broadened to include all personnel aboard the WASP**
- **The delay in aggressively broadening the investigation:**
 - ✓ **Increased the risk of exposure of TB to the rest of the crew and eventually to civilians**
 - ✓ **Made necessary subsequent investigations which were costly and manpower intensive**
 - ✓ **Did not take advantage of the natural quarantine afforded by being aboard ship.**



Lessons Learned

- ➔ **Ensuring compliance will always be a challenge (TST, Rx, Prophylaxis)**
 - ✓ **Three Marines and two Sailors developed TB because of poor compliance**
 - **Marine identified as a *converter* during initial WASP contact investigation failed to return for evaluation and treatment**
 - **Three cases developed (2 Marines, one Sailor) in individuals who converted, began INH and then failed to take the daily dose**
 - **Sailor lied about taking INH during 6-month follow-up**
 - ✓ **Numerous times during the investigations repeat TSTs had to be done because personnel did not return for skin test reading**



Lessons Learned

- **All medical care providers, from junior corpsmen to senior medical officers, must consider TB as a differential diagnosis when evaluating a patient who complains of chronic cough, even if the patient appears young and “healthy”**
- **Tuberculin skin tests should be placed and read by individuals experienced with the technique**
 - ✓ **Uncertain results or missed readings must lead to immediate repeat of TST**
- **Delays in TB diagnosis in the shipboard environment rapidly lead to compounding of problems, as demonstrated by this outbreak**



Review

Q. Why is the TST problematic in the detection and control of TB?

A. 1. It must be properly applied.

2. Personnel must return for “reading” in 48-72 hours.

3. It must be correctly interpreted.



Review



Q. What constitutes a positive TST?

***A. 5mm in a contact
investigation***

or

10mm in routine screening



Review

Q. What are the differences between an Active TB case and a routine reactor?

➤ **Active Case**

An active TB case is infectious: Signs and symptoms may include a Positive AFB Smear, Positive CXR findings, bloody

sputum etc.

A reactor is non-infectious and is asymptomatic



Review

Q. What are the four required components of a new reactor's routine "work-up"?

- A. 1. History & physical**
2. CXR
3. Baseline liver function tests
4. HIV test



Review

Q. Who needs to be screened in a TB contact investigation?

**R. *1. Spouse/significant others
2. Individuals sharing households
3. Individuals sharing berthing compartments
4. Individuals sharing workspaces***